CALIFORNIA MAGLEV deployment program

# PROJECT DESCRIPTION

# EXECUTIVE SUMMARY

## California MAGLEV Project

U.S. Department of Transportation

Submitted To:

U.S. Department of Transportation
Federal Railroad Administration


*Prepared under a cooperative agreement among the California Business, Transportation & Housing Agency, California High Speed Rail Authority and Southern California Association of Governments*

JUNE 30, 2000
*Revised July 6, 2000*

## BACKGROUND

This document was prepared in accordance with federal guidelines. [1]

United States Government Agencies and Legislators have been envisioning methods to realize a high-speed ground transportation system for over a decade. The National Maglev Initiative (NMI) was formed in April of 1990 and included the U.S. Department of Transportation (DOT), U.S. Army Corps of Engineers (USACE), Department of Energy (DOE), and other agencies to conduct and coordinate further research and evaluation for MAGLEV technology as a means to improve transportation. NMI also determined the appropriate role for the Federal Government in advancing this technology.[2]

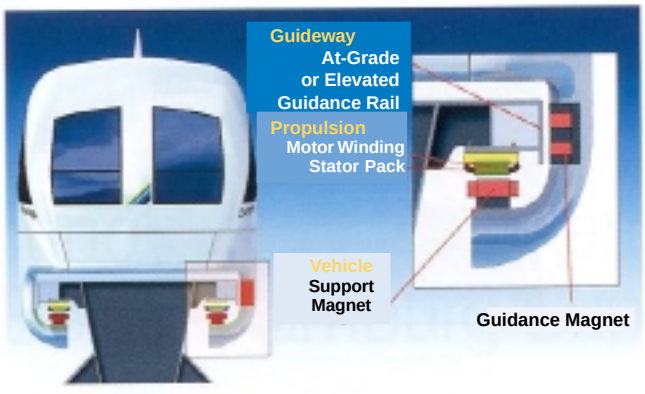
After many years of careful analysis and study, the conclusion is that MAGLEV is a viable technology for deployment in the U.S. The Transportation Equity Act for the 21st Century (TEA-21) established the MAGLEV Deployment Program to analyze, plan, and build a magnetic levitation rail system in the United States. The California MAGLEV Project was selected as one of seven applicants for pre-construction funding.

MAGLEV refers to technology that uses electromagnetic forces to suspend, propel, and guide vehicles over a specially designed guideway. MAGLEV combines magnetic forces with linear motor technology. For high-speed travel the vehicle is suspended above the guideway and propelled by magnetic forces powered by electric substations located at intervals along the route.

The technology selected for the California MAGLEV Project has no contact between the vehicle and guideway, thereby reducing friction levels to enable high-speed travel and have significant operational and maintenance cost savings. This technology was developed by the German Transrapid International GmbH & Co. KG. Parent companies include Adtranz, Siemens, and ThyssenKrupp.

This Executive Summary highlights the results and conclusions of the pre-construction planning phase for the California MAGLEV Deployment Project.

**MAGLEV Vehicle and Guideway**




[1] Applicable sections under 49 U.S.C. 322; 23 U.S.C 322; 49 CFR 1.49 (See Appendix ES).

[2] Final Report on the National Maglev Initiative (NMI), September 1993.

## PROJECT RATIONALE

Traffic congestion and delays in the southern California region have produced substantial impacts to the economic vitality, environmental attributes, and overall quality of life. Significant transportation initiatives by local agencies have provided some alternative transportation methods other than automobile travel to address this issue. In addition, considerable funds have been applied to improving the infrastructure to support the traveling public.

However, the regional population is expected to increase considerably over the next 20 years. In addition, job growth continues to increase in the coastal areas, while housing choices expand in the Inland Empire region. Currently, there is no reasonable way to expand the infrastructure required to support such population and employment growth.

The southern California economy contributes substantially to the overall United States economy by increasing import/export traffic in the largest port complex in the United States and the trans-formation from aerospace-related industries to service sector and high technology businesses.

An improvement to the mobility of southern California's travelling public has many positive implications for the region and beyond. The Project Description presents the foundation for a MAGLEV transportation system, and discusses implementation options in southern California for the greatest return on investment of federal funds.

## PROJECT STUDY OBJECTIVES

The challenges described in this Executive Summary require careful consideration in order to sustain the viability of the region. The California MAGLEV Deployment Project began as a call to action and evolved into provisions for a high-speed network in the Regional Transportation Plan (RTP) of 1998. TEA-21 provided a catalyst to boost the project into its current configuration. The following objectives provide the framework for the Project Description submitted to the Federal Railroad Administration (FRA) on June 30, 2000.

- Improve travel options and transportation access in this high-density, fast-growing corridor.
- Enhance regional connectivity by improving circulation of people and goods.
- Provide for an expandable high-speed transit system in the region and statewide.

- Provide improved access to major regional airports to meet increased air passenger and cargo demand.
- Connect jobs with more lifestyle options.
- Reduce the need for costly and environmentally disruptive expansion of the physically constrained freeways in the corridor.
- Allow for an expanded employment base.
- Improve regional air quality by reducing vehicle emissions.
- Improve mobility options to employment, educational, transportation, medical, special events, and retail centers for corridor residents.

Information is provided in this summary to address the requirements of the following project selection criteria under Section 268.17.

*a) Purpose and significance of the project.*

*(1) The degree to which the project description demonstrates attractiveness to travelers, as measured in passengers and passenger-miles.*

*(2) The extent to which implementation of the project will reduce congestion, and attendant delay costs, in other modes of transportation; will reduce emissions and/or energy consumption; or will reduce the rate of growth in needs for additional highway or airport construction. Measures for this criterion will include but not be limited to the present value of congestion reduction, pollution reduction, and/or facility cost-avoidance benefits.*

*(3) The degree to which the project will demonstrate the variety of operating conditions which are to be expected in the United States.*

*(4) The degree to which the project will augment a MAGLEV corridor or network that has been identified, by any State, group of States, or the FRA, as having Partnership Potential.*

## TRANSPORTATION PURPOSE & SIGNIFICANCE

**Project Definition**

The proposed California MAGLEV Project will provide high-speed ground transportation service between major activity centers in high-density, fast-growing urban areas. The project study area extends between Los Angeles International Airport (LAX), west Los Angeles, downtown Los Angeles Union Passenger Terminal (Union Station), San Gabriel Valley, Ontario International Airport, Riverside, San Bernardino, and the former March Air Reserve Base (March Inland Port). Goods and passenger transportation services will connect three counties in the region: Los Angeles, San Bernardino, and Riverside. The

Project is part of a proposed intra-regional high-speed MAGLEV system serving all of southern California and will connect with the proposed high-speed rail system serving the entire state of California.

**Candidate Alignments**

Alignment selection is an iterative process, dependent on many variables. Based on an initial engineering assessment, and in keeping with right-of-way limitations, six to nine possible alignments were considered between each major station pair *(see Figure ES-1)*. Candidate alignments were then selected for ridership modeling. Finally, the financing capabilities of candidate alignments were analyzed.

Because the Environmental Evaluation was to be completed by February 29 of this year, a candidate alignment was selected based on initial engineering factors, absent of ridership and financing capability. This alignment will be identified throughout the Project Description as the EA (Environmental Assessment) Alignment. Once preliminary, computer-based ridership estimating models were developed, projected ridership and financing were added to the analysis, and alignment alternatives were evaluated for financial performance. An initial "constrainable" alternative was identified that meets the project funding policy adopted by the Southern California Association of Governments. That policy calls for a project that can be funded within the constraints of potentially available federal funds authorized in TEA21 and revenue from MAGLEV system operations. Additional analyses will be conducted in order to arrive at a project that best achieves the overall program objectives for demonstrating MAGLEV technology in accordance with local, state and federal requirements and policies. While all of the candidate routes will continue to be evaluated during the next study phase, the analyses to date have led to a current emphasis on the corridor alignments shown in Figure ES-1, with end stations at LAX on the west and March Inland Port on the east.

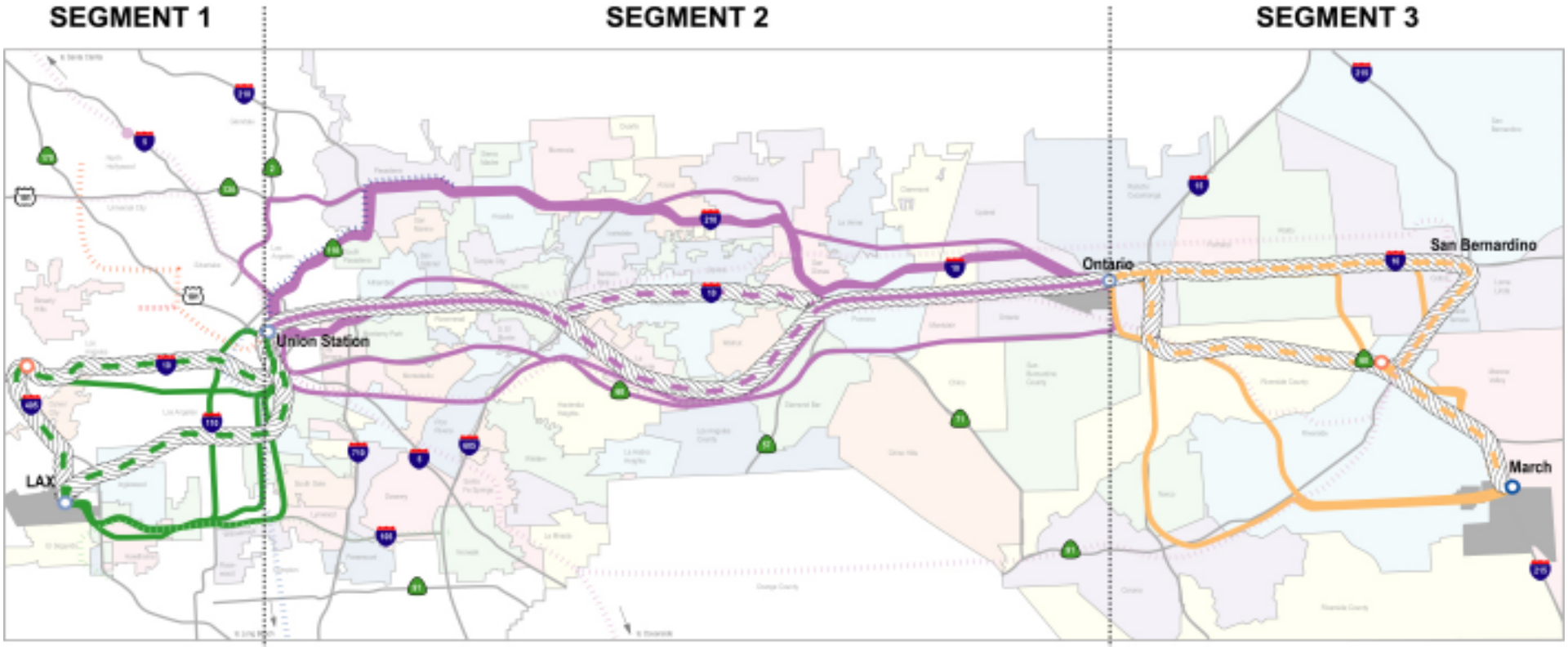
In ***Segment One***, two highly likely alternatives connect LAX to Union Station. By traveling north on I-405 from LAX and then east to Union Station on I-10 and adding a West Side station, passenger trips increase in the ridership model. The other alignment connects the LAX and Union Station via the MTA-owned Harbor Subdivision rail line. Capital costs, service parameters, and ridership are comparable and benefits and community impacts need further review in the next phase. Both options can produce a project capable of financing.

***Segment Two*** connects Union Station and Ontario via the UP West line and I-10. One alternative stays on the rail line with a potential station in City of Industry. The other viable alternative would cross over I-10 with a potential station in West Covina. Ridership and costs differentials need further evaluation, however either alignment can be financed within the parameters of the financial forecast.

In ***Segment Three*** one route analyzed follows I-10 and includes a station in San Bernardino, then continues south to the City of Riverside along I-215, with a station near SR-60. The other route follows I-15 to SR-60 to I-215 to March Inland Port (formerly March Air Reserve Base). This route segment, along with all other alignments identified in Figure ES-1, will continue to be analyzed for further development during the next phase of studies leading to preparation of an environmental impact statement/environmental impact report (EIS/EIR).

# Figure ES-1

## California MAGLEV
Route Variations




## Legend

- **SEGMENT 1** — LAX to Union Station route alternatives
- **SEGMENT 2** — Union Station to Ontario with mid-station route alternatives
- **SEGMENT 3** — Ontario to March Inland Port with San Bernardino and Riverside route alternatives
- **CURRENT EMPHASIS**

## RIDERSHIP & REVENUES

In the three-county region, projected 2020 home-to-work trips are expected to more than double between Los Angeles and San Bernardino counties, and to increase three- to four-fold between Riverside and San Bernardino counties. Based on the ridership forecasts prepared for the MAGLEV Project, approximately 700,000 daily long-distance trips are expected to occur in 2020 between the six MAGLEV station areas.

Given the opportunity to save substantial travel time, a number of travelers are expected to shift to the MAGLEV system. Anticipated ridership on the MAGLEV Project in year 2020 ranges from 75,000 to 90,000 daily trips, depending on the fare structure, time between trains (headway), and modeling assumptions.

The types of trips expected to be attracted to the high-speed MAGLEV service include:

- Journey-to-work and back home commute
- Airport access
- Airport to airport
- Business
- Visitor/recreation
- Interurban resident-based nonwork
- Event-based trips
- Goods movement

The journey-to-work trip is expected to capture the largest share of the total daily riders, between 30,000 and 34,000, followed closely by air passengers, at 24,000 to 28,000. Nonwork-related trips by residents make up the third largest group, which is between 11,000 and 15,000 MAGLEV riders.

Table ES-1 shows, for the various trip purposes, the range of total market share for MAGLEV of all trips in the corridor. MAGLEV achieves a range in market share of from two percent to nine percent of the travel markets shown.

**Table ES-1—Projected Ridership for 2020**

| Trip Type | Range in MAGLEV Ridership [1] | Total Daily Trips in Corridor | Percent Market Share |
|---|---|---|---|
| Long-distance Commute to Work | 16,000 32,000 | 700,000 | 2% 5% |
| Long-distance Resident Nonwork | 10,000 16,000 | 1,000,000 | 1% 2% |
| Air Passengers (LAX Ontario Airport March Inland Port) | 24,000 26,000 | 300,000 | 8% 9% |
| Special Events/Special Generator Visitors | 4,000 6,000 | 200,000 | 2% 3% |
| Induced Passenger Trips | 3,000 4,000 | N/A | N/A |
| TOTAL | 57,000 84,000 | 2,200,000 | 3% 4% |

[1] Assumes a 20-minute headway. Range in ridership is due to different fare and modeling assumptions.

N/A = Not Applicable

The number of MAGLEV passengers was also determined for individual segments and stations. In general, the largest number of year 2020 MAGLEV passengers are projected to ride between the mid-corridor stations (in the cities of Industry, West Covina and Irwindale) and Union Station, and between Union Station and LAX. Higher ridership in these areas is not unexpected since these stations serve the most densely populated and largest activity centers in the corridor.

According to the model, MAGLEV passenger trip lengths range from 27 to 33 miles long. These trip lengths clearly demonstrate that the MAGLEV Project is likely to be most attractive for the longer trips occurring in the corridor. The market share numbers in Table ES-1 for long-distance commute and nonwork trips confirm this.

The proposed California MAGLEV system can transport selected freight shipments as a commercial enterprise. Some expected MAGLEV users have expressed interest in using freight shipping. The three most significant freight-shipping features for the MAGLEV system are cycle speed, cycle reliability, and trip frequency. These features are already important to customers and to shipping freight. Anticipated freight will be containerized and prepared before the train arrives. Containers can be loaded quickly on moving floors and relatively few containers will be boarded per train. The system has the capacity and ability to have specifically designed freight cars that use freight containers for easy handling and boarding.

Anticipated annual passenger revenues, without revenues from goods movement and other revenue generating elements, for the EA Alternative in the year 2020 range between $285 and $310 million.

## PROJECT NEED

The growth in population and employment in the southern California region will continue in phenomenal proportions. An increase of 6 million people by 2020 will bring the population total to approximately 22 million people. Imagine adding two cities the size of Chicago to the region. Rate of growth will be highest in the outlying regions of Riverside and San Bernardino.

2020 Forecast for Population & Employment Growth **(Millions)**

| | 1994 | 2020 | |
|---|---|---|---|
| Population | 15.6 | 22.4 | 43% |
| Employment | 6.6 | 10.6 | 61% |


Employment will increase by 61%; but not in the same areas as population growth. This will create a substantial burden on the transportation infrastructure and commuting times will stretch to nearly three hours in some corridors.

This area will continue to be the Economic Engine for America. SCAG's Regional Comprehensive Plan and Guide depicts long-term economic strengths as follows:

- A large domestic market and access to both Western United States and Pacific Rim
- Nation's largest port and airport complex
- Large financial services complex serving both domestic and international markets
- Nation's largest tourism and entertainment complex
- Nation's biggest high-tech complex built around the region's educational institutions, large pool of skilled labor and venture capital industry
- Large and diverse manufacturing base
- Growing number of new, small and medium sized businesses. Southern California is attractive to immigrant entrepreneurs who bring energy, innovation, and international connections to the region. [3]

If the region were its own country, it would be ranked 12th for Gross National Product. California as a whole is ranked 8th.

In addition, the growth for airports is staggering. By 2020, passenger demand at the region's airports is expected to increase by more than 85 percent to approximately 154 million air passengers per year, while cargo demand is expected to triple, from three million annual tons currently to nearly nine million annual tons.

Like other metropolitan areas (such as New York, Chicago, Washington, and London) southern California must develop a comprehensive regional airport system to accommodate this ever-increasing demand.

As additional international air traffic continues to increase for the region, LAX, Ontario International Airport, March Inland Port and southern California's other regional airports must develop a strategy to accommodate passenger and freight demands.

The MAGLEV system will alleviate the need for 6 to 10 additional freeway lanes, and can defer or re-allocate billions of dollars in airport expansions.

## PROJECT SIGNIFICANCE

Southern California conditions and issues, combined with MAGLEV Project characteristics elevate the MAGLEV Project to national significance level. The California MAGLEV Project is the only one of seven projects submitted for consideration designed to serve multiple major population centers. Southern California has already proven its ability to develop and construct major public infrastructure projects using public-private partnerships, including the Alameda Corridor and the various toll road projects in Orange, Riverside, and San Bernardino counties.

Southern California provides the best opportunity to develop and demonstrate an intraregional MAGLEV system that will immediately serve tens of millions of annual passengers and produce more than enough fare revenue to operate cost-efficiently. The candidate alignment has produced an anticipated daily passenger ridership rate of approximately 75,000.

[3] SCAG, The Economy Chapter, Regional Comprehensive Plan and Guide, 1998 update

Southern California must reduce vehicular air emissions to meet established Clean Air Act air quality levels. The MAGLEV Project is a critical element needed to reach conformity with Clean Air Act provisions, and not meeting the conformity requirements of the Act would have major impacts on the regional economy under federal funding sanctions. Table ES-2 shows emission savings associated with the EA Alignment.

**Table ES-2—Emissions Savings: Value of Reduced Air Pollution Year 2020, Low Ridership Scenerio**

| Pollutant | Net Decrease in Emissions (Tons/Year)[1] | Value per Ton ($) | Total Annual Savings ($ millions) |
|---|---|---|---|
| CO | 988.0 | 11,055 | 10.92 |
| ROG [2] | 44.1 | 22,470 | 0.99 |
| $PM_{10}$ | 63.9 | 6,775 | 0.43 |
| $CO_2$ | 91,946.0 | 18 | 1.64 |
| $NO_x$ [3] | 157.7 | 31,385 | 4.95 |
| $SO_x$ | NA | 713 | |
| Total | 93,042.0 | | 13.99 |

[1]Decrease in emissions due to VMT reductions as a result of MAGLEV service less the increase in emissions due to MAGLEV power requirements.

[2]Reactive Organic Gases, which are ozone precursors. Emissions analysis was based upon change in Total Organic Gases, which are very similar.

[3]Area is in attainment with respect to national standard; savings are not included in benefits total.

Source: Parsons Engineering Science, Inc. and Parsons Transportation Group Inc.
USDOT, FRA, High Speed Ground Transportation for America, September 1997

*268.17 (b)*
*Timely implementation. The speed with which the project can realistically be brought into full revenue service, based on the project description and on the current and projected development status of the Maglev technology selected by the applicant for the project.*

## SYSTEM ELEMENTS OF PROJECT - ENGINEERING FACTORS

### Overview

MAGLEV system features include non-contact levitation and guidance, autonomous, safe-life on board power supply, and non-contact propulsion and braking for speeds up to 300 mph. The system provides for automatic, safe operation on an elevated guideway.

California MAGLEV trains would be modern, attractive, spacious vehicles that adhere to the latest aircraft, railroad, and public transportation standards. Trains would be composed of flexible, modular MAGLEV vehicles coupled together. The MAGLEV control system would be radio-based and decentralized and designed to be safe at all times for all foreseeable situations including seismic events.

The guideway would consist of high precision welded steel or reinforced concrete beams and reinforced concrete columns and foundations. Guideway beams would be mounted on bridge bearings on reinforced concrete substructures. In all cases, guideway substructures would be designed to meet local traffic, environmental, civil, bridge, and earthquake standards, regulations, and practices. The structures would also be protected from damage from external traffic using standard road guardrails, fencing, etc.

Where the proposed alignment includes Caltrans right of way, close coordination will occur to ensure that all the needs, issues and/or concerns are addressed making use of the Project Study Report (PSR) process. A California registered engineer on the MAGLEV team would prepare, sign, and seal the PSR. The PSR would be prepared concurrent with an Environmental Impact Statement (EIS) during the next phase of the project.

### Propulsion System

The propulsion system will be supplied with energy from one or more local utility companies, and in some locations from an internal power grid (within the propulsion system). The propulsion power is controlled and regulated by stationary equipment located in electrical sub-stations that would be located along the alignment.

MAGLEV system trains are propelled and braked using a synchronous long stator linear motor.

Ferromagnetic stator packs and three phase cable windings are mounted on both sides along the underside of the guideway. The operation of this non-contact, propulsion, and brake system is analogous to a rotating electric motor whose stator is cut open and stretched along the guideway and whose rotor function is assumed by the levitation magnets in the vehicle. In contrast to the rotating field in a conventional motor, the long stator linear motor produces an electromagnetic travelling wave, which propels the vehicle along the guideway.

Converters in substations along the route will change the strength and frequency of the alternating current to allow the vehicle to accelerate smoothly from standstill to full speed. By slowing down and/or reversing the direction of the travelling wave, the motor becomes a generator and the vehicle is braked, without contact, to a smooth, controlled, and safe stop (regenerative braking). In the event of public power or propulsion system failure, independent backup brakes in each vehicle will provide safe and accurate braking to the next available stopping area.

The MAGLEV propulsion system will be installed continuously along the route. The different propulsion components will be sized to fit the local topography and performance requirements. This results in a propulsion system, which is individually sized and configured to the requirements of the route.

Substations are planned at intervals of up to 35 km along the route. In addition to the propulsion and power conversion/conditioning components, the substations contain energy supply components as well as facilities for maintenance personnel, spare parts, etc.

**Safety**

For the safe operation of high-speed MAGLEV trains, the system must operate without directly intersecting other transportation modes. The MAGLEV guideway must be fully separated from all other forms of traffic. It will consist of a wide beam around which MAGLEV vehicles would partially wrap. The guideway provides the support surface for the magnetic levitation and the motor power to propel the train. The proposed guideway is a triangular steel beam with a wide flat top, about seven feet wide and about six feet deep. The beam would have the electrical parts of the linear motor built into the two sides near the top. The beam would have a smooth top to support the train, should it sit down on skids in an emergency stop.

Both the guideway and MAGLEV vehicles contain electromagnetic devices, and the interaction between these devices both levitates and propels the vehicles. Power to propel the vehicle is supplied to a section of guideway only during passage of the MAGLEV vehicle. When vehicles are not present, the guideway is electrically dormant.

## TECHNOLOGY SOURCING & TRANSFER

Magnetic levitation technology is an emerging and sophisticated transportation technology. The Superspeed MAGLEV System developed by Transrapid is one of the first very high-speed train systems in the world that uses this innovative technology. Under development in Germany since the early 1970s, it is now available for commercial service at a test track in Elmsland, Germany. The superspeed MAGLEV system's support and guidance systems function according to the principles of electromagnetic levitation, instead of the mechanical solutions used for over 150 years by traditional wheel-on-rail-systems.

The Transrapid technology has been selected as the basis for design for the California MAGLEV Project. Individually controlled, noncontact, conventional technology electromagnets located in the vehicle undercarriage attract themselves up to ferromagnetic reaction rails (stator packs) attached to the underside of the guideway. Individually controlled, non-contact, conventional technology electromagnets work together with the guidance rails to hold the Transrapid laterally on course. The individual support and guidance magnets are grouped together and mounted on both sides, along the entire length of the vehicle.

Transrapid International-USA, Inc. (TRI-USA) was created shortly after the establishment of Transrapid International GmbH & Co KG to support the American MAGLEV Deployment Program and emphasize the great importance of the U.S. market for the Transrapid technology. TRI-USA has exclusive rights to the Transrapid technology in the United States.

Transrapid International GmbH & Co. KG, its parent companies Adtranz, Siemens, and ThyssenKrupp, and its U.S. subsidiary, Transrapid International-USA, Inc. have pledged to cooperate with U.S. companies in MAGLEV project implementation as required by law and guarantee the performance of their product. Transrapid International has worked with various prospective U.S. partner companies for years, with the aim of cooperating with them on the implementation of a first Transrapid MAGLEV project in the USA. MAGLEV Deployment Program contains a legal requirement to design, construct, and operate with a minimum domestic content of 70 percent. The California MAGLEV Project easily meets this goal.

## SYSTEM DESIGN - OPERATIONAL CHARACTERISTICS

Initial analysis shows 20-minute headways as most cost-effective. Evaluations of train frequency and the associated cost reductions and their impact on revenue and project viability are ongoing. Ridership estimates show that a six-car train, seating 90 persons per car, is needed to meet initial year 2010 peak demand. The train will grow to an eight-car train by 2020. Stations are being designed to accommodate a ten-car train.

All MAGLEV facilities will be fully handicap accessible. Elevators will be provided for vertical circulation at stations and where required. The gap between the station platform and the train will be 1 inch or less, and there will be adequate space for securing wheelchairs on the cars. Seating on cars for commuter service will have adequate space for briefcases, umbrellas, and the other usual paraphernalia for short distance travelers (day trips). Trains for airport access service may have fewer seats and more personal space for luggage. Stations will function as fly-aways for LAX and Ontario airports. Fly-aways, pioneered in the Los Angeles Basin at Van Nuys Airport, allows passenger check-in and baggage checking at an outlying point, and then allows the traveler to proceed to the airport.

The California MAGLEV Project will use variable fares, priced on congestion management principles and stored value SMART Cards, to maximize passenger convenience and revenue generation. Trips will be priced based on time of day, day of the week, specific origin and destination, and length of time in advance that travel is purchased.

Stations and trains are planned to have at least one attendant on duty at all times. Both assignments are based more on passenger comfort than on technical operational necessity.

Beyond the infrastructure and vehicle subsystems, other important design elements that affect revenues and costs will be incorporated into the system concept from the beginning.

The project schedule for the EA Alignment is presented as Figure ES-2. Revenue service can begin in 2007, with full service operation by 2010.

*268.17 (c) Benefits for the American economy. The extent to which the project is expected to create new jobs in traditional and emerging industries in the United States.*

## PROJECT BENEFITS

The continued success of regional goods and people movement relies on having the transportation infrastructure in place to meet current and future mobility demands. Thus, failure to keep southern California moving now and in the future will have significant economic consequences for the entire nation. Indeed, the federal government, by classifying the Alameda Corridor freight rail project as a "Corridor of National Significance" and by providing a $400 million guaranteed loan to help finance its construction, already recognizes the importance of trade activity emanating from southern California and the profound impacts this trade volume has on the nation's overall economic well-being.

MAGLEV will also promote a new development concentration. Among the many benefits of MAGLEV-oriented development are:

- Building strong, cohesive, and sustainable communities by providing a focal point for concentrating and channeling growth.
- Increasing the quantity of affordable housing and creating opportunities for more diverse housing options.
- Increasing local community economic activity, property values, and tax base.
- Providing more travel options and better living environments for the transit dependent.
- Increasing the transit trips to a station area and decreasing the number of auto trips within the station vicinity.
- Improving air and water quality, and other environmental concerns due to reduced auto use.

**Potential Project Impacts**

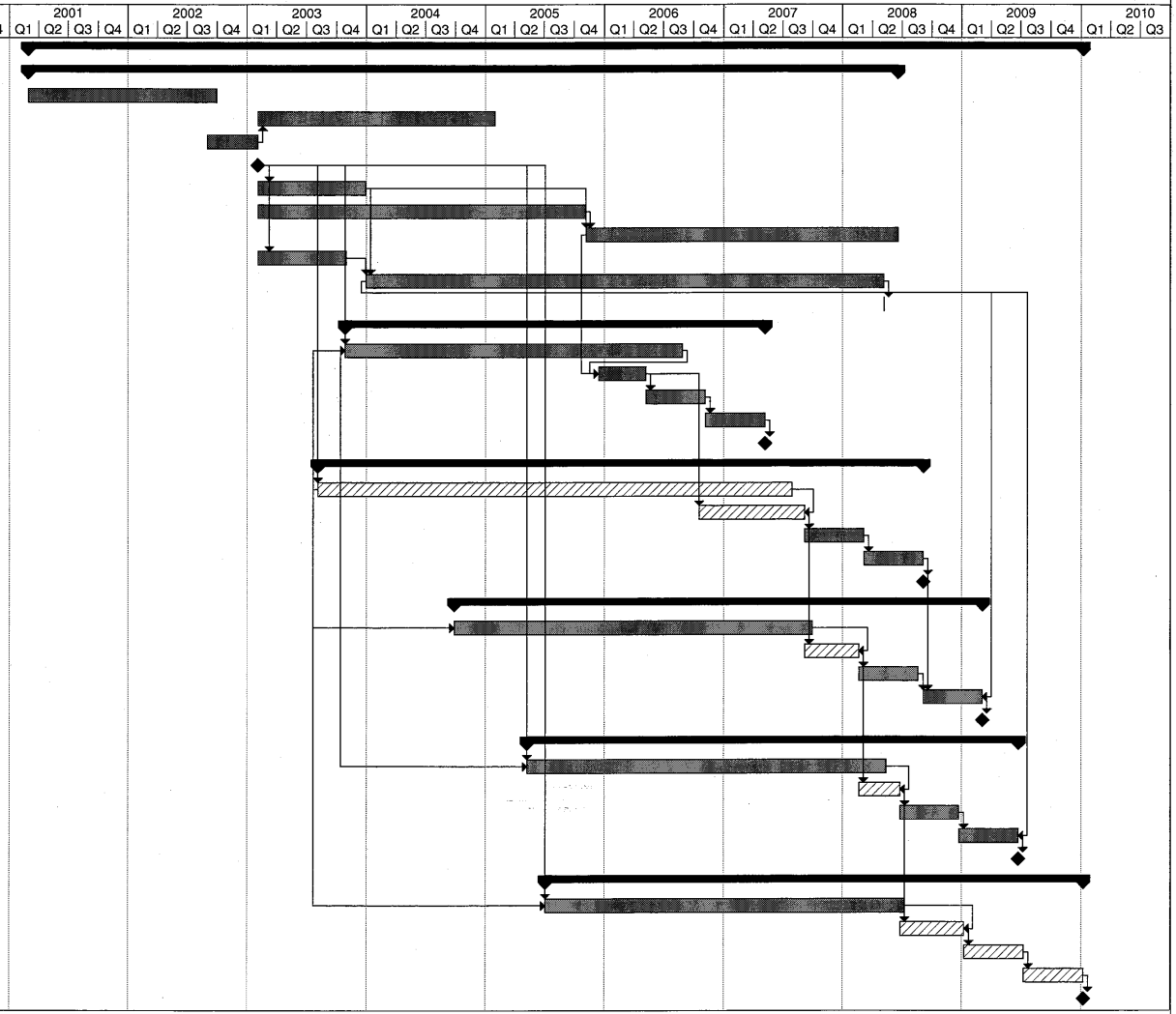
- *Noise*. MAGLEV trains traveling at speeds above 100 mph have potential noise impacts. Most high-speed trains running in the project study area will be within existing public rights-of-way, thereby limiting the level of impact. Where potential impacts to adjacent uses are still possible, they would be mitigated through various measures.

- *Community Disruption*. A transportation investment has the potential to increase community disruption if its alignment and structures cut through neighborhoods and present new travel barriers. The MAGLEV alignment will be largely grade separated and follow existing public rights-of-way whenever

# Figure ES-2

**California MAGLEV Deployment Project**
**LAX - March Inland Port, 20 minute Headway**
**Project Schedule**

| ID | Task Name | Duration | Finish |
|---|---|---|---|
| 1 | **California MAGLEV Project** | **2312 dys** | **Fri 1/8/10** |
| 2 | **General Duration** | **1905 dys** | **Wed 6/18/08** |
| 3 | Environmental Impact Statement | 82.6 wks | Mon 9/30/02 |
| 4 | Right of Way Acquisition | 104 wks | Mon 1/31/05 |
| 5 | Select Franchisee | 111 dys | Mon 2/3/03 |
| 6 | Start Construction | 1 dy | Mon 2/3/03 |
| 7 | Testing / License Guideway and Operation System | 236 dys | Tue 12/30/03 |
| 8 | Guideway Beam Facility "TYP I+II" | 719 dys | Fri 11/4/05 |
| 9 | Manufacturing (2732, 4 pieces per day) | 683 dys | Wed 6/18/08 |
| 10 | Vehicles Factory/Equipment | 194 dys | Fri 10/31/03 |
| 11 | Vehicles Manufacturing (2010) | 227 wks | Tue 5/6/08 |
| 12 | Vehicles Manufacturing (2020) | 1 dy | Wed 5/7/08 |
| 13 | **Section I (IND-ONT)** | **921 dys** | **Tue 5/8/07** |
| 14 | Substructure, Bridges | 740 dys | Mon 8/28/06 |
| 15 | Guideway Installation, 412 beams, 4 per day | 103 dys | Mon 5/8/06 |
| 16 | Final Completion / Subsystem Commissioning | 26 wks | Mon 11/6/06 |
| 17 | Internal Test Operation / Simulated Revenue Service | 26 wks | Mon 5/7/07 |
| 18 | Start of Revenue Service "Section I" | 1 dy | Tue 5/8/07 |
| 19 | **Section II (Downtown-Ontario)** | **1329 dys** | **Fri 9/5/08** |
| 20 | Substructure, Bridges | 1040 dys | Mon 7/30/07 |
| 21 | Guideway Installation, 922 beams, 4 per day | 231 dys | Thu 9/6/07 |
| 22 | Final Completion / Subsystem Commissioning | 26 wks | Thu 3/6/08 |
| 23 | Internal Test Operation / Simulated Revenue Service | 26 wks | Thu 9/4/08 |
| 24 | Start of Revenue Service "Section II" | 1 dy | Fri 9/5/08 |
| 25 | **Section IV (Ontario-Riverside)** | **1159 dys** | **Fri 3/6/09** |
| 26 | Substructure, Bridges, Tunnel | 785 dys | Mon 10/1/07 |
| 27 | Guideway Installation,472 beams 4 per day | 118 dys | Tue 2/19/08 |
| 28 | Final Completion / Subsystem Commissioning | 26 wks | Tue 8/19/08 |
| 29 | Internal Test Operation / Simulated Revenue Service | 26 wks | Thu 3/5/09 |
| 30 | Start of Revenue Service "Section IV" | 1 dy | Fri 3/6/09 |
| 31 | **Section V (Riverside-March)** | **1077 dys** | **Wed 6/24/09** |
| 32 | Substructure, Bridges, Tunnel | 785 dys | Mon 5/12/08 |
| 33 | Guideway Installation, 358 beams, 4 per day | 90 dys | Tue 6/24/08 |
| 34 | Final Completion / Subsystem Commissioning | 26 wks | Tue 12/23/08 |
| 35 | Internal Test Operation / Simulated Revenue Service | 26 wks | Tue 6/23/09 |
| 36 | Start of Revenue Service "Section V" | 1 dy | Wed 6/24/09 |
| 37 | **Section III (Downtown-LAX)** | **1179 dys** | **Fri 1/8/10** |
| 38 | Substructure, Bridges | 785 dys | Mon 7/7/08 |
| 39 | Guideway Installation, 568 beams, 4 per day | 142 dys | Thu 1/8/09 |
| 40 | Final Completion / Subsystem Commissioning | 26 wks | Thu 7/9/09 |
| 41 | Internal Test Operation / Simulated Revenue Service | 26 wks | Thu 1/7/10 |
| 42 | Start of Revenue Service "Section III" | 1 dy | Fri 1/8/10 |




Project: California MAGLEV Project
Date: June 30, 2000

Task | Progress | Summary | Rolled Up Critical Task | Rolled Up Progress | External Tasks
Critical Task | Milestone | Rolled Up Task | Rolled Up Milestone | Split | Project Summary

possible. It is not expected to become a barrier and disrupt travel patterns or require major street realignments. MAGLEV has the potential to decrease the disruptive effects of transportation facilities by lessening the need for new roadway and related construction and by providing an alternative, fast travel connection between different communities in the study corridor.

- *Habitat, Water Quality, Wetlands*. Preliminary studies performed during preparation of the Environmental Assessment identified only minor impacts in any of these areas. During more detailed design studies in the next phase, the issues will be re-evaluated in greater detail. Negative impacts to these environmental resources may occur if a project requires additional, sensitive lands and/or generates run-off or other pollutants that adversely affect water resources. Based on the work to date, the potential disbenefits from disruption of habitat, water quality and wetlands by MAGLEV construction and operation are not considered significant.

*268.17 (d) Partnership Potential. The degree to which the project description demonstrates Partnership Potential for the corridor in which it is involved, and/or for the project independently.*

## PARTNERSHIP POTENTIAL

The California MAGLEV Project demonstrates the highest possible partnership potential. Its very high ridership potential, resulting from the dense corridor in which the project is located, will generate sufficient revenues to cover all operating costs and approximately 80 percent of capital costs. This strong revenue stream will attract a high level of interest from financial markets and project development firms from around the world. In fact, letters of interest have been received from 60 such firms.

The high partnership potential has been affirmed by Goldman Sachs, which has carefully reviewed the basis for the financial plan and confirmed that the project is viable as proposed.

The public-private partnership approach to be used to implement the project has been successfully used in southern California on similar large-scale public works projects. That record of success will be replicated with the California MAGLEV Project.

## THE MANAGEMENT PLAN

The California MAGLEV Deployment Project will be implemented by a public-private partnership in the following manner:

An existing public entity will be used to serve as the MAGLEV public implementing authority. The Southern California Regional Airport Authority (the Regional Airport Authority) has been identified to serve as this entity. The Regional Airport Authority has been formed through a joint powers agreement (JPA) among local county governments and airport agencies under state law (Public Utilities Code Section 130255). SCAG will transfer the lead role in MAGLEV development, and as the project moves forward, the SCAG role will lessen, since SCAG's primary role as the Metropolitan Planning Organization does not involve direct project development.

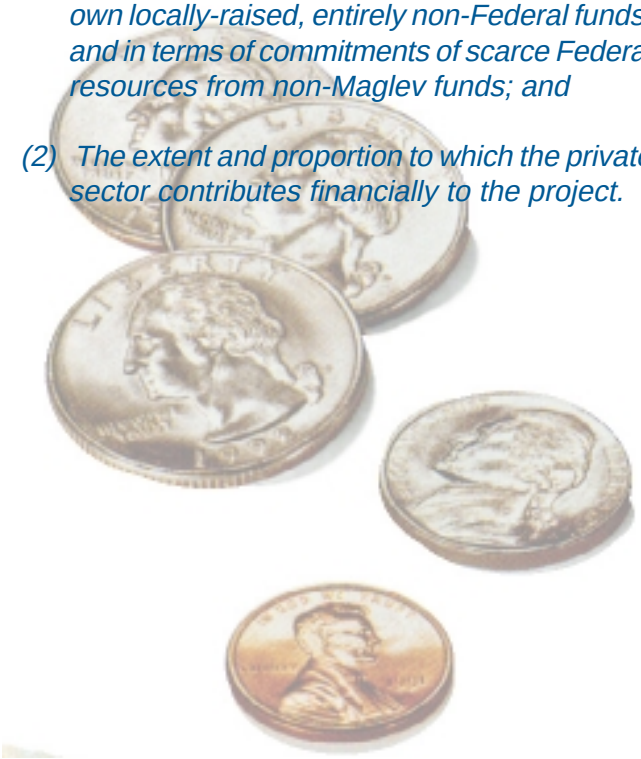
The Regional Airport Authority will be project sponsor acting as the snow plow that clears the path and enables the project to move forward on schedule. The Regional Airport Authority will secure the needed environmental clearances and arrange for use of the public and possibly the railroad rights-of-way necessary for project construction. Some station and other rights-of-way for system facilities (e.g. the maintenance facility, electric substations, access roads, etc.) may also be arranged or purchased by the Regional Airport Authority or by the successful franchise applicant.

During preparation of the environmental documentation, the Regional Airport Authority will issue a conditional request for franchise applications to the private sector. Private companies will respond to the request for franchise applications by forming teams to design, build, and operate the system to compete for the franchise. Two such teams exist, and a third and possibly a fourth are forming. The franchise will be issued immediately following the Record of Decision. The Regional Airport Authority will issue bonds to pay for construction, backed by the revenue stream that will be generated from system operation.

*268.17 (e) Funding limits and sources.*

*(1) The extent and proportion to which States, regions, and localities commit to financially contributing to the project, both in terms of their own locally-raised, entirely non-Federal funds, and in terms of commitments of scarce Federal resources from non-Maglev funds; and*

*(2) The extent and proportion to which the private sector contributes financially to the project.*



## PROJECT COSTS

While MAGLEV is a new technology, most of the components are the same or very similar to existing construction projects. The columns carrying the guideway are similar to those used in highway construction. The construction of stations, parking lots, electrical substations, etc. is similar or identical to other rail projects. Capital cost estimates have been developed using an extensive database of Caltrans construction costs along with other appropriate construction cost experience for specialized construction.

The construction cost of the system ranges from $4 billion to $6 billion dollars, depending on the service capacity that is provided and the alignment choices that are made. Since the primary fiscal goal is self-sufficiency, the optimum balance between construction cost and net operating revenue must be met.

The California MAGLEV Project is unique in that it builds from the inside out, from the densest urban cores of the Los Angeles basin, relying on the commuter demand and airport connection ridership for its core user base. Tapping into such concentrated unmet demand allows for ridership levels that can support not only the operations and maintenance costs of the system, but also provides for a large amount of debt service repayment. Unlike other proposed MAGLEV proposals, this transit project, situated in the most congested corridor in the nation, achieves farebox recovery in excess of the cost of operating and maintaining the system and serves a substantial number of daily riders. This combination of high feasibility and broadly applied utility puts the California MAGLEV Project head and shoulders above all other projects.

**Financial Plan Characteristics**

| Daily Ridership in Year 2020 | Annual Revenue | Ratio (=40x Rev/Capital) | Capital Cost | Annual O &M Costs | Funding Gap | Annual Passenger Miles |
|---|---|---|---|---|---|---|
| 75,630 | $394 M | 3.3 | $4.8 B | $81 M | $3,250,000 | 741 M |

## FINANCIAL PLAN

The preliminary financial plan shows that the project can support a combination of bonding and loans, with emphasis on TIFIA loans, and that the needed grant contribution is within the $950 million specified in TEA-21. With the assumptions of ridership and revenue generating a positive cash flow from the first year after revenue service, the bonds will be retired and the loans repaid in 2044. Issues of concern in the preliminary financial plan include the length of construction, because of the interest debt incurred over that time period, the overall leverage, and the plan's vulnerability to interest rates.

In terms of alternatives competing for the System's base of riders, no valid and timely alternative exists. Only the regional highway, interstate highway, and Metrolink rail systems serve the corridor at present. An inspection of the peak and non-peak time transit times for all of these modes shows a "pent up" demand that has accrued over the years to the benefit of the project's feasibility.

Investors will scrutinize such demand forecasts and ridership projections in order to achieve comfort in building a new mode of transportation such as MAGLEV. The densities found in the LA Basin achieve the levels required to satisfy investors as to demand for such a system.

The following chart identifies the financial instruments to be used for the project.

| Financial Instrument | In Dollars ($) |
|---|---|
| Par Amt. Of Bonds | $2,840,610,00 |
| TIFIA Loan | 1,016,750,000 |
| FRA Grants | 950,000,000 |
| Other | 3,250,000 |
| Interest Earnings | 1,655,565,943 |
| Project Cost | 4,800,000,000 |
| Debt Service Reserve Fund | 223,760,614 |
| Capitalized Interest | 1,331,535,938 |

## Appendix ES

Specifically the following section of 49 U.S.C. 322; 23 U.S.C 322; 49 CFR 1.49 applies:

Section 268.3
(c) *Phase II—Project Description Development (July 1, 1999—June 30, 2000).*

(1) Description. In Phase II, each grant recipient will prepare and submit to FRA a project description, supporting preconstruction planning reports, and an EA. Supporting reports may include demand and revenue analyses, project specification, cost estimates, scheduling, financial studies, a system safety plan (including supporting analysis), and other information in support of the project description. FRA will use this information in reaching a decision on which projects to down-select for completion of site-specific environmental studies, investment grade revenue forecasts, and other studies and analyses necessary prior to initiation of construction. FRA will initiate documentation of environmental factors considered in the project selection process.

*(2) Timing of Major Milestones.*

*(i) February 29, 2000—Deadline for submission of appropriate EA's needed by FRA for the down-selection of one or more projects under Phase III.*

*(ii) June 30, 2000—Deadline for submission of project descriptions and any related supporting reports needed by FRA for down-selection of one or more projects.*

*Section 268.11 Project eligibility standards.*

*(1) As required by 23 U.S.C. 322(d)(4), in order to be eligible to receive financial assistance, a MAGLEV project shall:*

*(i) Involve a segment or segments of a high-speed ground transportation corridor that exhibit Partnership Potential;*

*(ii) Require an amount of Federal funds for project financing that will not exceed the sum of Federal MAGLEV Funds, and the amounts made available by States under STP and CMAQ;*

*(iii) Result in an operating transportation facility that provides a revenue producing service;*

*(iv) Be undertaken through a public and private partnership, with at least \1/3\ of Full Project Costs paid using non-Federal funds;*

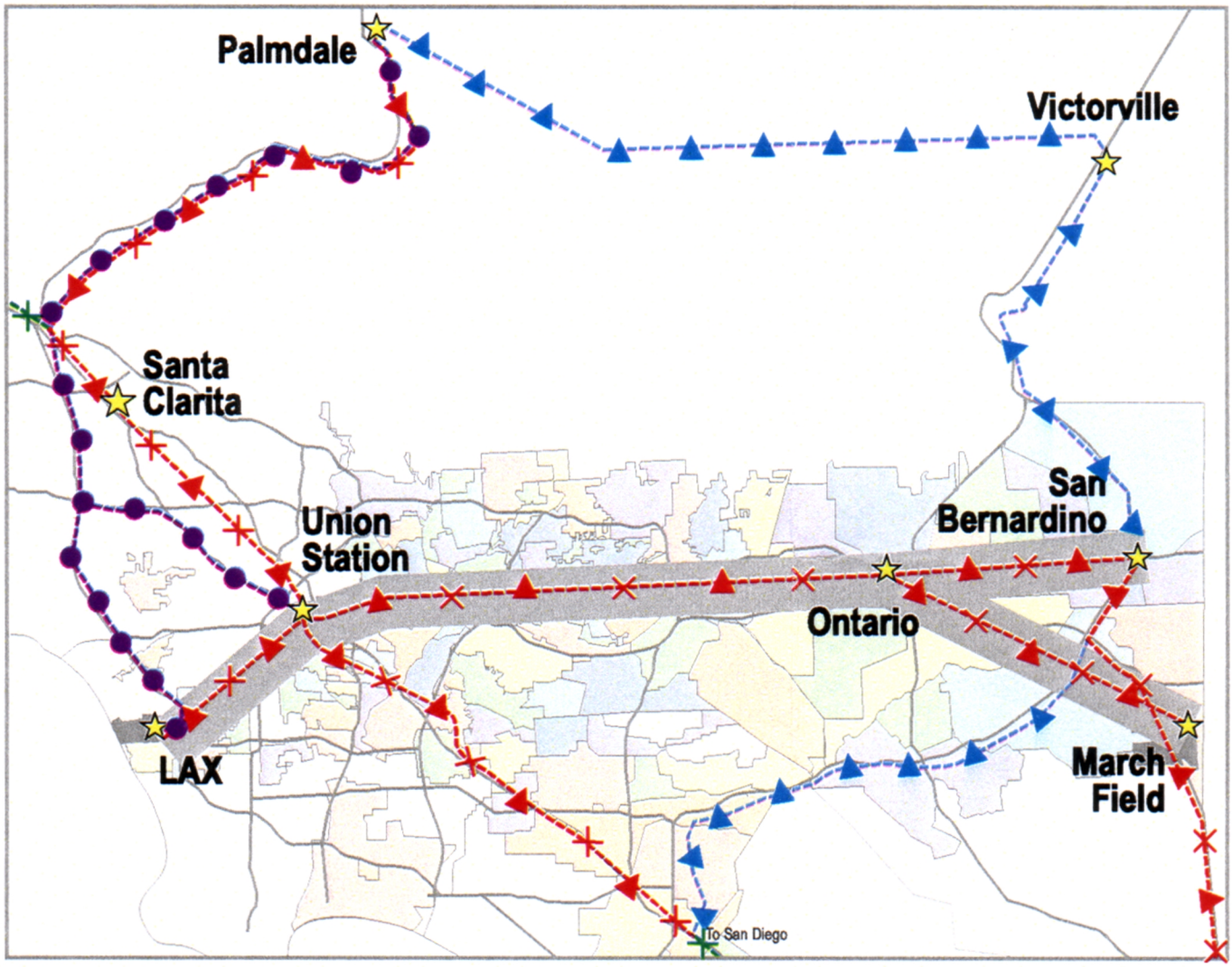
*(v) Satisfy applicable statewide and metropolitan planning requirements;*

*(vi) Be approved by FRA based on an application submitted by a State or authority designated by one or more States;*

*(vii) To the extent that non-United States MAGLEV technology is used within the United States, be carried out as a technology transfer project; and*

*(viii) Be carried out using materials at least 70 percent of which are manufactured in the United States.*

# Regional High-Speed MAGLEV System




**Regional MAGLEV and High Speed Rail Legend**

| Route | |
|---|---|
| | SCAG MAGLEV System |
| | California High Speed Rail Authority |
| | Both Systems |
| | LAX-Palmdale (Connector to Union Station) |
| | Stations |
| | MAGLEV Corridor |

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